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Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.

Vol. XL. No. 7.

A NEW MYLODON.

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BY

GLOVER M. ALLEN.

WITH FOUR PLATES.

CAMBRIDGE, U. S. A.:
Printed for the Museum.
September, 1913.

TROPICAL PACIFIC.

The following Publications of the Museum contain Reports on the Dredging Operations in charge of Alexander Agassiz, of the U. S. Fish Commission Steamer "Albatross," during 1899 and 1900, Commander Jefferson F. Moser, U. S. N., Commanding.

I. A. Agassiz. Preliminary Report and List of Stations. With Remarks on the Deep-Sea Deposits by Sir John Murray. Mem. M. C. Z., Vol. XXVI. No. 1. January, 1902. 114 pp. 21 Charts.

II. A. G. Mayer. Some Species of Partula from Tahiti. A Study in Variation. Mem. M. C. Z., Vol. XXVI. No. 2. January, 1902. 22 pp. 1 Plate.

III. A. Agassiz and A. G. Mayer. Medusae. Mem. M. C. Z., Vol. XXVI. No. 3. January, 1902. 40 pp. 13 Plates, 1 Chart.

IV. A. Agassiz. The Coral Reefs of the Tropical Pacific. Mem. M. C. Z., Vol. XXVIII. February, 1903. 33, 410 pp. 238 Plates.

V. C. R. Eastman. Shark's Teeth and Cetacean Bones from the Red Clay of the Tropical Pacific. Mem. M. C. Z., Vol. XXVI. No. 4. June, 1903. 14 pp. 3 Plates.

VI. W. E. Hoyle. Cephalopoda. Bull. M. C. Z., Vol. XLIII. No. 1. March, 1904. 71 pp. 12 Plates.

VII. H. Ludwig. Asteroidea. Mem. M. C. Z., Vol. XXXII. July, 1905. 12, 292 pp. 35 Plates, 1 Chart.

VIII. W. E. Ritter and Edith S. Byxbee. The Pelagic Tunicata. Mem. M. C. Z., Vol. XXVI. No. 5. August, 1905. 22 pp. 2 Plates.

IX. Mary J. Rathbun. The Brachyura. Mem. M. C. Z., Vol. XXXV. No. 2. August, 1907. 54 pp. 9 Plates.

X. C. H. Gilbert. The Lantern Fishes. Mem. M. C. Z., Vol. XXVI. No. 6. July, 1908. 24 pp. 6 Plates.

XI. A. Agassiz. Echini: The Genus Colobocentrotus. Mem. M. C. Z., Vol. XXXIX, No. 1. November, 1908. 8, 33 pp. 49 Plates.

XII. J. Murray and G. V. Lee. The Depth and Marine Deposits of the Pacific. Mem. M. C. Z., Vol. XXXVIII. No. 1. June, 1909. 170 pp. 5 Plates, 3 Maps.

XIII. W. C. Kendall and E. L. Goldsborough. The Shore Fishes. Mem. M. C. Z., Vol. XXVI. No. 7. February, 1911. 106 pp. 7 Plates.

XIV. H. Heath. The Solenogastres. Mem. M. C. Z., Vol. XLV. No. 1. June, 1911. 180 pp. 40 Plates.

XV. A. M. Westergren. Echini: Echinonëus and Micropetalon. Mem. M. C. Z., Vol. XXXIX. No. 2. August, 1911. 34 pp. 31 Plates.

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A NEW MYLODON.

While collecting fossils in Nebraska, in 1880, for the Museum of Comparative Zoölogy, Mr. Samuel Garman obtained a nearly perfect skull, together with a large part of the skeleton of a Ground-sloth, Mylodon. Since the remains of this genus hitherto discovered in North America have been extremely fragmentary, it seems desirable to publish a brief description of the specimen and to make such comparisons as possible between this and other described species. It proves to be a true Mylodon, approaching in certain respects the genus Paramylodon, and like the latter seems to have been a browsing rather than a grazing type such as *M. robustus* and *M. harlani* must have been. Since it appears to represent an undescribed species, I have named it in honor of its discoverer.

Mylodon garmani, sp. nov.

Type.— Well preserved skull and parts of the skeleton, No. 8429 M. C. Z., from the Pleistocene of the Niobrara River, Nebraska. Samuel Garman, 1880.

Horizon.— The locality is practically the same as that of the Hay Springs fauna, probably Mid Pleistocene, though precise details of the situation are lacking.

General Characters.— A large species of about the size of *M. harlani*, from which it differs conspicuously in the conformation of the last molars, the fifth upper molar being in outline like a figure 8 with a constriction in the middle on either side; the fourth lower molar much elongated and laterally compressed, with the greater axes of the internal lobes nearly longitudinal instead of transverse. Skull high and much narrowed from side to side, with high sagittal crest; pterygoids deep and rounded in side view, palate long and narrow with a very deep and narrow interpterygoid fossa. Edentulous portion of the tip of the rami much contracted.

Description of Skeleton.

In the following description of the type specimen, I have as far as possible made comparison with *Mylodon robustus*, *M. harlani*, and *Paramylodon*

nebrascensis. Of the first, Owen's classic memoir (1842) treats in detail, and the Museum possesses a mounted skeleton from the Pampas formation of Argentina. No complete account of the North American *M. harlani* has been published, and since the type consisted of but a portion of the lower jaw with the teeth, some doubt attaches to the identification of other fragments of the skeleton later referred to the same species. Cope (1895) first described and figured what are doubtless the upper teeth of this animal, and Leidy and others have described and figured bones which are believed likewise to represent it. No complete skull seems to have been found, but Cockerell in 1909 published an account of a cranium without teeth from Colorado which, after careful comparison of photographs, I believe is identical with *M. harlani*. To the same species are probably referable the teeth on which Cope founded *Mylodon renidens* and *M. sulcidens*, names currently included in the synonymy of *M. harlani*. Cope's *Mylodon sodalis*, based on an ungual phalanx, remains unknown. The description of *M. garmani* follows.

The *skull* (Plates 1, 2) except for the loss of a few chips here and there, is practically perfect and is clearly that of an adult animal. In general outline it resembles that of other species of Mylodon, but is extremely narrow. The dorsal profile is a nearly straight line with a slight depression above the orbit (in the specimen the actual depression is accentuated through a slight crushing in of the skull). The palatal profile is nearly parallel with the general dorsal outline but its plane if produced backward, would pass nearly through the center of the occipital condyles, as in Paramylodon. The pterygoids extend downward from the palatal plane to a distance about equal to one half the height of the braincase. The rostrum in side view is abruptly truncate, its general outline nearly at right angles to the dorsal profile. The upper half is convex, the lower half nearly vertical, or slightly concave, thus resembling Cockerell's specimen from Colorado, here considered *M. harlani*, but differing from Paramylodon, in which the lower half extends gently forward and downward. The maxillae and premaxillae extend some 80 mm. in advance of this boundary. The posterior profile of the skull is gently and evenly convex, beginning at a point on the dorsal margin directly above the posterior base of the squamosal process. Its curve if continued passes through the posterior third of the occipital condyle, thus more as in Paramylodon than in the Colorado skull whose condyles lie mostly outside the posterior outline of the cranium.

In dorsal view, the most striking character is the extreme narrowness of the braincase, whose greatest breadth, measured at the junction with the

squamosal process, is slightly less than the width between the rounded supraorbital processes. The heavy occipital crests meet the strong sagittal crest on the braincase in a slightly overhanging ridge, which passes anteriorly into the smooth surface of the frontal region, with a poorly defined prolongation to the blunt supraorbital angle. The sides of the braincase are nearly vertical and their surface is much roughened for the attachment of the temporal muscles. Anterior to the orbit the rostrum is broader and nearly square, with much less elongation than in Paramylodon. The tips of the nasals, though slightly damaged, seem to have been convexly rounded, and did not project beyond the sides of the muzzle. The latter is slightly inflated and smooth.

The outline of the nasal opening, viewed from in front, is a trapezoid, of which the base, formed by the bones of the palate, is parallel to the top, which is formed by the nasals. The width of the base is nearly double that of the top, so that the sides (*i. e.* the maxillaries) converge dorsally. There is no indication of a bony nasal septum.

The posterior view of the skull is almost horseshoe-shaped in outline, with the convexity dorsal. The extreme narrowness of the braincase is here emphasized by the fact that the extreme height of this occipital face is considerably greater than the width, whereas in the Colorado skull, as in Paramylodon, this face is much wider than high, so that its outline is nearly a semicircle. A strong median ridge extends from the upper lip of the foramen magnum dorsally to the lambdoid ridge which forms the boundary of the posterior face of the skull. On each side between the condyle and the lambdoid ridge is a triangular depression, whose surface is marked by several small ridges, for the attachment of the digastric muscle. The foramen magnum, as in Paramylodon, looks downward as well as backward, and about one half the surface of the condyles is ventral.

In ventral view, (Plate 2, fig. 3) the palate is seen to be long, contracted posteriorly and expanded anteriorly with its greatest width just in front of the first tooth. In contrast to the form of palate shown by *Mylodon robustus*, that of the present species is produced some 50 mm. anterior to a line joining the front edges of the first teeth, and is long, narrow, and very slightly expanded anteriorly, instead of being broad, blunt, and with widely divergent sides. The interpterygoid fossa is extremely deep and narrow. Its walls are parallel, and anteriorly converge to form a pointed arch. The pterygoids are likewise parallel to the long axis of the skull and diverge but little ventrally in contrast to those of the Colorado skull and Paramylodon, in which the pterygoids flare widely apart.

The *mandible*, in comparison with that of the latter genus, is of especial interest. The coronoid process is smaller, and the ramus, instead of tapering strongly towards the symphysis is of nearly the same depth at that point as at the level of the last molar, which is in correlation with the less elongated rostrum.

Certain of the cranial bones and the teeth require further mention.

The *nasals* are broad anteriorly, with a combined width of 70 mm. at the nasal orifice but taper rapidly back to about the level of the orbit, where, on account of the nearly complete disappearance of the median boundary through fusion and by reason of a slight crushing of the frontals, their outlines cannot be traced. Apparently, however, there is little if any indication of a posterior expansion such as Brown figures in Paramylodon.

The *malars* (Plate 3, fig. 7) or jugal bones are complete and separate. Probably they were but loosely articulated with the maxillaries. The upper anterior portion is concavely rounded to form the lower border of the orbit. The ascending wing of the bone has a deep notch for the reception of the squamosal process. In the South American *Mylodon robustus* the portion of bone dorsal to the notch is produced backward so that the distance from its tip to the point of the notch is nearly twice that from the tip of the bone forming the ventral side of the notch to the same point. This bone is not described for any of the North American species nor for Paramylodon, but in our specimen it presents the noteworthy difference that the bony wings forming the sides of the notch are of nearly equal length, the dorsal only some 10 mm. longer than the ventral portion. The descending portion of the malar is similar to that of *M. robustus* in general form but is narrower and longer, with a wider concavity between it and the ascending portion. Its anterior margin is also much less bowed out.

The *premaxillaries* were evidently united, but were only loosely articulated with the maxillaries by a short stem which fitted into a deep median cleft between them at their anterior end. The lateral wings of the premaxillaries bevel over the dorsal surface of the tips of the maxillaries, but are wholly separate from them. The cleft for the reception of this articulating stem of the premaxillaries extends posteriorly as a broad V for about 31 mm., or nearly one half the distance from the tip of the maxillary to the first tooth. It is apparently much deeper in the Colorado skull and in Paramylodon, extending nearly to the level of the large oval tooth (the second in Mylodon). The greatest median length of the premaxillaries is 54 mm., their combined width 96. The tips are thickened and slightly concave below as if for aiding the prehensile power of the lips.

The *palate* is much roughened and pitted, with a narrow rounded ridge passing down the center from the level of the front of the first tooth to a point opposite the back of the penultimate molar. A similar ridge, but apparently of less extent, seems to be indicated in the Colorado skull, beginning on a level with the second tooth. The maxillopalatal suture extends forward to the level of the penultimate molar, and the palatal bone itself is smooth. A large foramen is present at each side behind the last molar.

The *pterygoids* in side view are very large and extend some 75 mm. below the general outline of the palate. In this respect they resemble those of Paramylodon and differ conspicuously from those of *Mylodon robustus* and the Colorado skull in which the pterygoids extend but slightly below the general ventral outline. Their interior surface, except for a narrow roughened rim, is smooth, but the exterior bears many small bony ridges for muscle attachments. There is a broad shallow concavity in the posterointernal part of each.

What appears to be the tympanic bone is a narrow horseshoe-shaped element fused solidly with the os petrosum on each side. Posterior to this is a roughened depression 15 to 20 mm. in diameter for the reception of the articulating process of the stylohyal. The foramina for the eleventh and twelfth nerves are internal to this depression and slightly posterior to it. The latter is the larger, about 15 mm. in diameter.

The *occipital condyles* have the characteristic bordering ridge, said to be absent in Paramylodon. Their ventral surfaces are set obliquely to the frontal plane and constitute more than half the articulating area. In ventral view the transverse diameter is much greater than the longitudinal, 59 and 42 mm. respectively. In the Colorado skull the length of the condyles seems to be greater in proportion to the width.

Teeth.— There are five teeth in the upper and four in the lower jaw on each side. The upper series measures 160 mm. in alveolar length, the lower 156; the toothrows in both jaws converge towards the posterior end of the palate. The last upper tooth is but 21 mm. from the level of the posterior narial opening, a distance equal to about two thirds of its own length. In the Colorado skull the last tooth is much farther from this opening (58 mm.) nearly twice its own length.

The *first upper molar* is the smallest, slightly oval in outline, and a trifle recurved. Its crown therefore is directed posteriorly, and this appearance is further enhanced by a slight bevel due to contact with the anterior part of the crown of the first lower molar. Its diameters at the alveolus are:— longitudinal,

19 mm., transverse 15, thus much the same as in *M. harlani* (see Cope, 1895). The beveled surface of the crown is 20 long. The tooth projects about 19 mm. from the socket and is separated from the second by an interval of only 9 mm.

The *second upper tooth* likewise has its anterior portion recurved so that the crown is directed backward at a small angle to the palate. The front face is slightly beveled by contact with the posterior facet of the first lower tooth, but the crown opposes the second lower tooth. The general outline in section is an ellipse, with a longitudinal diameter of 36 mm., transverse 17, at the alveolus. The tooth figured by Cope (1895) as the second upper molar of *M. harlani* is similar but with a much greater bevel on the anterior face.

The *third upper tooth* has three lobes, an outer with nearly square outline, and two inner, of which the posterior is much the longer with nearly parallel sides and rounded ends. A shallow sulcus separates these two lobes at the lingual side of the tooth. The posterior lobe forms a long heel which is bent at an angle of nearly 45 degrees from the axis of the tooth row toward the median side. The outline is not essentially different from what Cope (1895, pl. 10) figures for *M. harlani* and *M. renidens;* and as nearly as may be judged from a photograph, the tooth is practically the same in the Colorado specimen. The anterior inner lobe is about opposite the single outer lobe, but so deflected is the posterior lobe that its tip is in the same straight line as that of the first. The extreme breadth anteriorly is about 24 mm.; the length in the axis of the tooth row from tip of the anterior inner lobe to the back of posterior lobe is 29.6 mm., while the diagonal from the point of the latter to the tip of the outer lobe is 33 mm.

The *fourth upper tooth* is narrow and compressed in the long axis of the toothrow, but is set at an angle of nearly 45 degrees to the latter. It has three lobes, as does the preceding tooth, two inner and one outer, but the last is considerably in advance of the anterior inner lobe; and the posterior inner lobe is not much elongated, apparently much less so than in *M. harlani* and *M. renidens*, as figured by Cope. In this respect the Colorado skull seems to resemble these two species and to differ from our specimen. There is thus a greater dissimilarity in the shape of the third and fourth upper teeth of our animal than appears in the three others. So compressed is it, that its outline is roughly a parallelogram, slightly concave on the posterior outline. The dimensions are: — tip of anterior inner lobe to tip of outer lobe 30 mm.; from the latter point to tip of posterior inner lobe 35.5 mm.; front of anterior inner to end of posterior inner lobe 19 mm.

The *fifth upper tooth* differs decidedly from that of *M. harlani* and *M. reni-*

dens in that its outline is more that of a figure eight, with a marked constriction or waist which divides the tooth into a slightly larger anterior lobe with the outer corner in advance of the inner, and a smaller posterior lobe only slightly asymmetrical. The long axis of the tooth coincides with that of the toothrow, and measures 30.5 mm.; the breadth of the anterior lobe is 20 and of the posterior 15 mm. In *M. harlani* and in *M. renidens* the tooth has a slightly concave external outline with a more marked internal concavity, but the posterior lobe thus defined does not expand again terminally, and the same is apparently the case in the Colorado skull.

The *mandible* in lateral outline resembles that of *M. robustus*, except that owing to the extreme narrowness of the skull, the symphysis is less broadly truncate. The anterior external openings of the dental canal are three in number, arranged in longitudinal series. The anteriormost is very large, the two others much smaller and subequal. The vertical diameter of the first is 14 mm., of the smaller ones about 7 mm. In Paramylodon the middle foramen is the largest. The predental part of the jaw is much narrowed as seen from above, in marked contrast to the broad square termination of *M. robustus*. This fact points to a narrow extensile tongue, for a browsing, rather than a grazing habit, which makes use of a broad symphysis for cropping. The tip of the jaw is slightly damaged.

As already noticed, the ramus tapers but little in side view, from base of the coronoid process forward, in marked contrast to Paramylodon in which the jaw is but one half as deep at the symphysis as at the base of the coronoid process. Directly above the posterior end of the symphysis, the tip of the jaw slopes upward above the level of the toothrow so that the depth at the extreme tip is quite equal to that at the base of the coronoid process, nearly 105 mm. The condyle is slightly above the level of the toothrow, with its long axis nearly transverse.

The toothrows of the lower, as of the upper jaw, converge posteriorly. The extreme alveolar length of the row is 156 mm. The four teeth are set close together and though of the general Mylodon type, differ in details from those of other species known.

The *anteriormost lower tooth* projects some 24 mm. above the alveolus, and about half that distance above the crowns of the succeeding teeth. In Paramylodon this tooth projects much farther above the alveolus. Its outline is elliptical in section, scarcely reniform, since the inner side is nearly flat instead of concave. The crown presents an anterior and a posterior beveled surface,

the former much more nearly in a transverse plane than the latter. The two facets meet at a point slightly posterior to the vertical axis of the tooth. The long diameter of the tooth, which coincides with the axis of the toothrow, is 25 mm., the breadth 16 mm.

The *second lower tooth* has a broad squarish external lobe, and two narrower internal lobes, of which the posterior is the longer and beveled by contact with upper molar 3. Compared with *M. harlani* the anterior lobe seems better defined by a fairly deep sulcus, which in the latter species is merely a shallow concavity, as figured by Leidy (1855). It corresponds fairly well with the tooth figured by Cope (1895) as the second inferior molar of *M. renidens*, but is smaller. The discrepancies in outlines, however, seem trivial.

The *third lower tooth* has roughly the outline of a boot, of which the toe and heel form respectively the anterior and the posterior external lobes, and the boot leg the longer internal lobe with nearly parallel sides. This lobe is much better marked off than in *M. harlani* or the two species described by Cope as *M. renidens* and *M. suleidens*, in which the outline is roughly a parallelogram with rounded angles. Indeed, it is difficult to see how these last two can be distinguished from *M. harlani* if small discrepancies are discounted. *M. suleidens* was named on the basis of a separate third lower molar, closely resembling that of *M. renidens* but with the dimensions of the corresponding tooth of *M. harlani*. According to its describer "the internal extremity of the crown is beveled on the posterior border, so that an obtuse ridge characterizes the posterior side of the crown, which is separated from the posterior border of the external face." The same condition is found in our specimen and is the result of wear against the upper third molar. The differences claimed as separating *M. suleidens* from *M. harlani*, must, I think, be considered merely individual. The greatest length of the third lower molar is at an angle of nearly 45 degrees to the tooth row, and in our specimen measures 35 mm., practically as in *M. harlani* (33 mm.); the breadth across the two external lobes is 23 mm. as against 20 in the latter.

The *fourth lower molar* is very different from that of any species hitherto known, in its extreme elongation and lateral compression. As in *M. harlani* and Paramylodon it consists of an anterior and a posterior lobe connected by an isthmus. Each lobe has an internal heel. The long diameter of these lobes is nearly transverse to the axis of the toothrow in *M. harlani* and in Paramylodon, but in the specimen here described is at only a slight angle to this axis. On the external side there is a slight concavity opposite the first internal lobe, but this is much more marked in *M. harlani* and in Paramylodon is a sharp depression.

Immediately following it, as in the former, is a slight convexity which is further developed in Paramylodon to form a small but fairly well-defined lobe. The extreme length of the tooth is 64 mm., against 55.5 in *M. harlani* and 56.4 in Paramylodon. Its greatest breadth is 23 mm., across the posterior end.

The *hyoid apparatus* (Plate 3, figs. 5, 6) is complete, and apparently for the first time allows the description of these bones in the genus. The stylohyal is the longest, 130 mm. in extreme length, with an irregularly rounded stem, expanding dorsally into a squarish plate at whose anteroventral corner is a rounded projection for articulation with the skull. Distally it bears a transverse articular surface. What corresponds to an epihyal articulates by a flat surface with the ventral end of this bone. It is compressed laterally and its distal portion is transversely expanded with an elliptical articular facet, 14 × 10 mm., on its posterior face. Its extreme length is 62 mm., or about half that of the stylohyal. A third and smaller bone of trapezoidal outline, with a small elliptical facet on each of its convergent sides, serves for the articulation of the epihyal with the body of the hyoid. This series of three bones is present on both sides, and the two smallest, or ceratohyals, articulate each with the facet of a protuberance marking either end of the body or basihyal. The last is thoroughly ankylosed with the thyrohyals to form a V-shaped bone, whose sides are a little expanded dorsally and whose point is widely emarginate at its posterior border. A small facet at the posterior tip of each cornu probably marks the attachment of cartilage. Leidy has figured (1855, pl. 7, figs. 7, 8) the corresponding bone in *Megalonyx jeffersoni*, but it differs in having the tips of the cornua much smaller, tapering from the body.

The correspondence of the hyoid bones with those of the Nine-banded armadillo, as described by Burmeister (1871) is complete, though his figure of these bones in a young animal indicates that the articular protuberances of the V-shaped arch are actually the ends of the thyrohyals, while the basihyal is a small piece wedged in between them. In the armadillo the stylohyal is shown to be smaller than the epihyal; and the ceratohyal as in Mylodon, is a small ossicle.

Vertebrae.— Of the vertebral column, the cervicals, several dorsal, and a few caudal vertebrae are preserved, but the sacral region and most of the pelvis are lacking.

The *atlas* (Plate 4, fig. 19) is in general similar to that of *M. robustus* as figured by Owen, but at its anterior end is slightly more emarginate in dorsal outline medially. The lateral boundaries are more nearly parallel instead of in-

curved, and the posterior corners are scarcely produced beyond the level of the articular facets, whereas in *M. robustus* they extend considerably beyond them. The positions of the vertebrarterial foramina are very different. In Owen's species the anterior and posterior foramina of the dorsal side are so close together as to be nearly in the same depression, a condition which is fully realized in *Megalonyx jeffersoni*. In our specimen, however, the posterior foramen is 27 mm. behind the anterior and of very much smaller size. The transverse diameters are 18 mm. and 8 mm. respectively. The ventral and posterior aspects of the atlas are much as in *M. robustus*. It measures:— greatest transverse diameter, 193; greatest depth 106; breadth across anterior articulating facets, 117; breadth across posterior articulating facets, 89; least longitudinal diameter in midventral line, 37.

The *axis* (Plate 4, fig. 20) differs from that of *M. robustus* mainly in that the superior margin of the spinous process is at a much less angle to the long axis, due to greater elevation of its anterior projection. The articular facet of the odontoid process faces more ventrally and the cranial articular facets are apparently more elliptical, with diameters 49 × 31 mm. Posteriorly the dorsal spine is deeply hollowed out to receive the spinous process of the third cervical. The height from the ventral border of the centrum to the tip of the spine is 130 mm.; the diameters of the posterior face of the centrum are:— transverse, 54; vertical, 41.

The remaining *five cervical vertebrae* are present though without their transverse processes. The spines of the third and fourth cervicals are thick and rugose, but become more compressed and smooth on those behind. The cranial articular processes become also broader and more roughened on their anterior surfaces. The front edge of the neural spine of the third vertebra is produced in a ridge forward, that fits into a deep hollow in the back of the spine of the axis. In the fourth cervical this ridge does not bow forward but slopes evenly to the tip of the spine, and the same is true of the remaining cervicals. Beginning with the third, the posterior margins of the neural spines are produced backward so as to enfold the anterior edge of the spine next succeeding for about half its height. The result is that the neck vertebrae by thus firmly interlocking, have but little lateral play upon each other. The seventh cervical, as in *M. robustus*, has a concave articular facet for the capitulum of the first rib, situated at each side of the centrum posteriorly. The anteroposterior length of the centrum is about the same (34 mm.) in the third to fifth cervicals but is slightly greater (38) in the two others.

Parts of sixteen *dorsal vertebrae* are preserved, in some cases enough to reconstruct nearly the entire bone. Vertebrae 8 to 13 are almost complete, but of the eight following, the centra and pedicle portion are broken or imperfect so that reconstruction is difficult. Probably there were sixteen dorsals. In *Mylodon robustus* there were sixteen pairs of ribs.

The centrum of the *first dorsal* is roughly elliptical as seen from in front, with a transverse diameter of 59 mm., and a vertical of 40 mm., as measured on the articular surface. The posterior face is not so wide, and like the anterior, bears the demifacets at the sides. The pedicles rise from the anterior upper corners of the centrum, are short, thick, and oval in section. The cranial articular facets are broadly elliptical, with their long axes nearly transverse. The neural spine is some 145 mm. high from the anterior dorsal edge, thin and compressed, but with a greater width posteriorly, where it is ridged vertically. The summit is flattened, its sides diverging posteriorly to a width of 21 mm.

In the *succeeding vertebrae* the centrum becomes more or less triangular in face view. This is first observable in the next but one, (tenth), the posterior face of which is distinctly three-cornered with the ventral point rounded. The sides also are concave. In the sixteenth vertebra the centrum is largest and deepest (62 mm. anteriorly).

With the eleventh vertebra the pedicle increases in length until it arises from nearly the whole side of the centrum; at the same time it becomes gradually much reduced in thickness on successive vertebrae. The cranial demifacets of the ninth vertebra are borne on the anterior base of the pedicel; the caudal demifacets at the dorsal corner of the centrum. The tenth vertebra is similar but the cranial demifacets are more elongated vertically. In the eleventh they become lateral. The caudal demifacets are mainly borne by the posterior base of the pedicle, and seem to become obsolete at about the eighteenth vertebra.

The transverse processes, so far as preserved, are at first broad and irregular in shape, with a prominent anterior point and two posterior ridges. A facet for articulation with the tubercle is present externally. Posteriorly on succeeding vertebrae the two ridges lengthen and diverge forming a Y on the 14th to 16th or 17th vertebrae. The inner fork of the Y at length becomes much the longer until finally it forms a ridge with an obtuse angle. The entire transverse process grows successively more elevated and longer, with a groove of increasing size that passes from the outer to the inner side of the ridge.

The cranial articular facets of the 3d to the 8th vertebrae are all slightly

concave, with the general plane of their surfaces parallel with the frontal plane. They are borne directly over the pedicels, those of the 3d and 4th with their greatest diameter longitudinal, and of the 5th to 8th with this diameter transverse to the direction of the spinal column. This feature, together with the imbrication of the posterior over the anterior ends of the neural spines limits greatly the sidewise movement of the neck vertebrae, but allows much freedom of motion in a vertical direction.

With the ninth vertebra the cranial facets become shifted medially so as to occupy nearly the entire length of each side of the arch. Their plane thus makes an angle of nearly 45 degrees with the transverse axis. The facets themselves measure some 50 mm. in long diameter by 20 in anteroposterior length.

On the tenth and succeeding vertebrae the cranial facets tend to increase in their anteroposterior diameter and to diminish in transverse extent so as to become more or less irregularly rounded from the 13th to 20th. This is accompanied by a flattening of the anterior portion of the vertebra, so that from the 13th onward, these facets look directly upward. The 22d and 23d vertebrae show enlarged facets, those of the former with a slightly different angle of slope at their ventral half, those of the latter practically divided into two contiguous oval facets, the lower partly in advance of the upper and facing slightly outward. The 24th vertebrae is lost, but judging from the caudal articular facets of the 23rd, there were two wholly separate cranial articulations on each side.

A remarkable structure occurs on the 17th vertebra in the shape of a *third caudal* articular facet with the form of an elongated oval, situated on the posterior face of the dorsal spine 30 mm. from its tip and 11 mm. from the paired caudal facets. This articulates with a third median facet of similar shape on the front of the 18th vertebra at the base of the neural spine. The facet on the 17th vertebra measures 39 mm. in length by 14 mm. in breadth. The third posterior facet of the 18th vertebra is broader and not so long (36 × 17 mm.) and 39 mm. from the tip of the spine. That of the 19th vertebra is again longer (52 × 18 mm.) and differs further in that its lower end extends between the tips of the two lateral caudal facets. In the 20th and 21st vertebrae the condition is similar, except that the facet becomes successively smaller (30 × 18 mm., and 25 × 14 mm. respectively). The 22d vertebra (Plate 4, fig. 17) has the anterior third facet, corresponding in size to the posterior facet of the preceding vertebra, but it has none on its posterior surface. This additional articulation is thus present on the posterior face of the 17th and the anterior face of the 22d vertebrae, and on both faces of the four intervening. According to Owen (1842) this

character is absent in the South American *Mylodon robustus*, but is found in Megatherium "through a great proportion of the posterior part of the dorsal region." In connection with the shape of the skull and rostrum it may indicate an adaptation for a browsing rather than a grazing habit through allowing an increased mobility of the trunk in reaching upward for leaves and twigs. (See Plate 4, figs. 17, 18).

The vertebral spines deserve a passing mention. Those of the 3d and 4th vertebrae are low, stout, and rugged, expanded terminally. The remaining cervical spines are destroyed but seem to have become thinner and higher. The 8th, or first dorsal, has a spine some 135 mm. from the median edge of the arch to the tip. The anterior portion is compressed but becomes thickened posteriorly. The spines of the 10th and 11th vertebrae are the longest, about 140 mm. from the lip of the foramen. From this point they increase somewhat in thickness, but diminish slightly and regularly in length, and more in the degree of elevation, so that the posteriormost are much more flattened than those at the anterior end of the column. The summits of the dorsal vertebrae are at first oval (46 × 25 mm. in the 10th vertebra), in outline, but become successively longer, narrower, and from the 16th on, more nearly triangular in outline, with the pointed end anterior. The summit of the 21st vertebra measures 56 mm. in length and 31 in breadth at the posterior end. There is no reversal of the slant of the spines nor any material change in their general shape in the posterior part of the column, as is likewise true of *M. robustus*.

The lumbar and sacral portions of the skeleton had evidently been long exposed above ground, so that nothing but fragments of the pelvis remain, barely sufficient to reconstruct part of the right ilium. The terminal fourteen vertebrae are, however, nearly intact and the centra of three more large caudals likewise are present though somewhat distorted. The 11th to 14th caudals, counting from the terminal one, are of essentially similar appearance. The anterior and posterior faces of the centrum are of practically the same size, nearly circular and about 53 mm. in diameter, but the anterior end is slightly the higher above a transverse plane, and this feature is noticeable in all but the last few caudals. The transverse processes arise along nearly the entire side of the centrum, and measure in the 12th vertebra from the end, 70 mm. from anterior point of union with the centrum to the extreme tip. They are directed backward, and rapidly decline in size to mere lateral ridges in the 7th to the 3d from the end of the series. The last vertebra to have caudal articular facets is the 11th from the end, so that the 10th is consequently the last to have cranial

articular facets. The ascending processes on which these are borne at once become more rod-like and diminish in size to mere protuberances at the anterior edge of the centrum, yet still distinguishable on the penultimate vertebra. In the 7th vertebra from the end, the roof of the neural canal becomes open. The terminal vertebra is a rounded knob, 24 × 20 mm. in transverse and vertical diameters, hollowed slightly on its anterior face and thickened ventrally. A slight median emargination marks its dorsal side. All but the last three caudals have articular facets for the chevron bones. The fourth from the end has fused with the chevron between it and the next anterior vertebra. All the seven chevrons preserved are slightly larger on one side (usually the left) than on the other, and are deeper anteriorly.

Ribs.— Unfortunately the ribs are broken into many fragments and these are preserved in part only. From a study of the vertebrae it seems clear that there were sixteen pairs that had articulation by the head and the tubercle as shown by the facets on those bones. In *Mylodon robustus* there were also sixteen pairs each with double articulation.

A portion of the first rib is preserved, showing it to have been thin but broad, rather short and curved. What were probably succeeding ribs, are represented by thin flattened pieces. The stoutest ribs of all were over 50 mm. broad at the upper portion with the external outline irregularly ridged. The articulating facets are nearly or quite flush with the general surface of the surroundng bone, not raised as tubercles or constricted off. A depression of varying size is present internal to the tubercular facet.

Sternum.— A large portion of the manubrium and five of the sternebra are preserved. The former seems to have been composed of two pairs of elements, thoroughly fused, as indicated by a transverse suture still traceable separating the anterior from the posterior pair. There is a median round perforation extending quite through the anterior portion of the manubrium, indicating the original separation of the two lateral elements. Compared with that of *Mylodon robustus*, the manubrium is much shorter and proportionately broader; the greatest width was apparently about the same as the length, but owing to the loss of parts of the periphery, exact measurements cannot be given. As in the former species one pair of sternal ribs seems to have articulated wholly with the manubrium on lateral protuberances borne at the widest portion and at about one half its length, or just in advance of the second pair of fused sternal elements. Posterior to this is a sudden contraction marking the second portion of the manubrium, whose demifacets for articulation with the second pair of sternal ribs are lost.

Of the remaining sternebra there are five preserved, four of which are apparently consecutive and at the posterior half of the series. These are more or less squarish in dorsal view, with a demifacet at each corner ventrally, the two larger at the anterior corners. As in *M. robustus* the articulation of each sternal rib except the first is by means of these demifacets, and two others borne by a median ventral keel on each sternebrum. In two of the pieces this keel is nearly as long as the sternebrum, in another it is much shorter. The fifth sternebrum has no demifacets at the posterior corners, and so was probably the last to articulate with the ribs. The hinder part of its keel is lost. This piece differs further in its narrowness and greater proportional length. It articulated with yet another posterior piece, which seems to be lost. In *M. robustus* the last piece of the sternum is similar to the one here believed to be the penultimate segment. Following are the measurements of these five pieces:—

	1st	2d	3d	4th	last
Median length of dorsal surface	52	56	59	56	63
Greatest anterior width across demifacets	60	57	63	57	50
Least transverse width (near middle)	51	49	49	40	33
Greatest posterior width	50	55	55	42	41
Greatest length of ventral keel	36	36	51	51	44?
Greatest depth (tip of keel to dorsal border of sternebrum)	—	69	53	55	—

In a mounted skeleton of *M. robustus* in the Museum, there are eight sternebra.

But five of the sternal ribs are entire, and these seem to be of the same type as in *M. robustus*. Two of the smaller measure 157 and 146 mm. respectively in greatest length. Distally there are two oval facets, their tips meeting, which articulate with the facets on the keels of two consecutive sternebra. A short distance proximal to these is a single rounded facet with more or less indication of two faces for articulation with the demifacets at the dorsal corners of the sternebra. The largest sternal rib preserved is 282 mm. long, and differs in having a single large terminal facet instead of two. It has also an oval elevated rugosity 38 × 18 mm., at the first third of its length dorsally, which probably served for muscle attachment. In the middle portion of their length these sternal ribs show a T-shaped or Y-shaped cross section, the stem of which forms a ventral keel. Two other small sternal ribs are flattened and without the keel. In one of these the terminal facets for four articulations are continuous, forming a closed ring. The distal portions of those ribs that did not articulate with the sternum, ended in tapering bony points, one of which is preserved.

Scapula.— Neither scapula is complete but the fragments put together supplement each other. The general form and structure are similar to what Owen has described and figured for *M. robustus*, but the dimensions differ slightly as shown by the following: —

	M. ROBUSTUS	M. GARMANI
Point of coracoid arch to anterovertebral angle	—	290
Glenoid cavity to vertebral border, opposite spine	—	325
Greatest length of glenoid cavity	127	113
Greatest breadth of glenoid cavity	76	73
Longest diameter of supraspinal aperture formed by union of acromion and coracoid	127	150
Shortest diameter of same	76	57
Greatest height of spine	89	84
Diameter of coracoscapular foramen	25	37
Long diameter of clavicular facet	—	44

The spine divides the scapular surface nearly in halves, and is highest at the point where the arch formed by acromion and coracoid, begins; that is, at about 30 mm. from the edge of the glenoid cavity. Its external edge is broadly flattened, 25 to 21 mm. across, then slightly expands to 45 mm. opposite the center of the aperture formed by the fusion of coracoid and acromion. In *M. robustus*, this portion is somewhat wider. The remarkable fusion of the acromion with the so called coracoid is characteristic of the sloths, and the homology of the bones shows that the clavicle articulates as usual with the acromion process, which has thus become greatly extended anteriorly and fuses with the coracoid. The coracoscapular foramen is somewhat larger than in *M. robustus*. This perforation is present in the anteaters as well as the sloths. Concerning the homology of the so called coracoid in the mammals, Ameghino (1909), Lydekker (1893), and Howes (1892) have made critical comparisons among fossil and living Edentates and conclude that the bone to which this name has been applied is not the same as the coracoid of the Reptilia. Lydekker states that in the sloth Bradypus, the coracoid forms part of the glenoid cavity, but this should be verified. In a specimen of Myrmecophaga, in which the sutures of the scapula are still discernible, the coracoid stands directly over the anterior portion of the glenoid, but does not actually form part of it, since it is separated therefrom by the epiphysis of the scapula, that extends forward underneath it. The appearance is at first as if the coracoid formed the anterior portion of the articulation, but this is seen on closer examination not to be the case.

The clavicles are broken, but the portions articulating with the acromion are present. This articulation was by a convex facet slightly constricted off from the shaft of the bone, and elliptical in outline. The shaft is elliptical in section becoming slightly flattened, and apparently more slender than in *M. robustus*.

The *humerus* is essentially similar to that of *M. robustus*, but is perhaps a little smaller as nearly as can be determined in its shattered condition. In side view the head is nearly hemispherical, but from the dorsal aspect is seen to have the condylar surface mainly on its inner half and tapers anteriorly to conform to the general outline of the glenoid cavity of the scapula. Its longest diameter is 111 mm. The great development of the deltoid crest in *M. robustus* is seen likewise in this species. The pectoral crest seems to be less pronounced. From the trochin to the distal end of the deltoid rugosity is 275 mm., against about 256 in Owen's species. From the latter point to the tip of the rounded portion of the condyle is about 155 mm., giving a total length of about 430 mm. for the entire humerus. Owen gives about 445 for *M. robustus*. The distal end has the same peculiar articulating surface, the outer half rounded, more than half a circumference in its anteroposterior extent, the inner half nearly flat. The entire articular surface is 125 mm. in transverse extent, which is about as in *M. robustus*.

The *ulna* is represented by the proximal portion only. The most striking difference in comparison with *M. robustus* is the greater length of the superior, flattened articular surface which is much longer than broad (diameters 97 × 55 mm.), instead of about as broad as long; while the inferior concave articulation is likewise proportionately narrower and is actually separated from the superior facet. A deep depression lies between the two. This inferior articulating surface is contiguous anteriorly with a smaller one, nearly round and flattened in the frontal plane, that serves for articulation with an elliptical facet at the proximal border of the radius. The ulnar has therefore three distinct articulating facets at the proximal end, two for contact with the humerus and one for contact with the radius. To judge from Owen's figure of *Mylodon robustus* the radial facet seems to be distinct from that for the humerus instead of confluent with it.

The *radius* is similar to that of *M. robustus* in size and shape. The proximal end is an elliptical concave facet, whose diameters are 71 and 50 mm. respectively, for articulation with the humerus. On the ventral border of this is the small elliptical articulation for the ulna. Distally the radius gradually

expands to an extreme width of 117 mm., with a median ridge which begins at a point about half way on its length and widens into the roughened distal end. The terminal surface has two chief articulating faces, one concave, the other smaller and convex, for the reception of the carpals. The total length of the radius is 290 mm. or practically the same as in *M. robustus*.

The bones of the fore feet are not all preserved, but most of the *metacarpals* and *phalanges* are represented. These seem to be nearly identical with those of Owen's species, but are a trifle larger and slenderer. Digits 1, 2, and 3 were provided with powerful claws; digits 4 and 5 were clawless, and terminated in blunt, rounded ossicles. The first ungual phalanx (Plate 3, fig. 10) measures 90 mm. in extreme length and differs from the others in having a stem some 25 mm. in length, the long axis of which is bent at an angle with that of the claw-bearing portion. This angle seems much greater than in *M. robustus*. The proximal face is slightly concave. The bony core of the claw is some 55 mm. long, laterally compressed, and regularly tapering in side view to a blunt point. The basal half is surrounded by a thin bony sheath which becomes much thickened and rugose at the base ventrally (Plate 3, fig. 10).

The second ungual phalanx (Plate 3, fig. 9) is without a stem-like proximal portion, but the base articulates directly with the next phalanx by means of two concave facets which are contiguous in the median line, and have their greatest length in a dorso-ventral plane. The sheath at the base of the bony core is extensive, some 45 mm. long laterally. The bony core of the claw is 90 mm. long, slightly decurved, with a thickness from side to side of 26 mm. near the middle. It tapers abruptly to a blunt and rather flattened point. An angular ridge marks off the flattened ventral surface of the claw. The phalanx next proximal to this is short, 53 mm. long, with two rounded facets anteriorly, and a broadly concave facet posteriorly. On each side of the latter, at its ventral corners, is a small squarish facet which evidently articulated with a sesamoid.

The third clawed phalanx (Plate 3, fig. 8) is extraordinarily large and powerful, 180 mm. in extreme length. It is shaped in general like that of digit 2, except that it is more falcate and its inner side has a broad and shallow sulcus beginning near the summit about half way to the point and increasing in breadth and depth to the tip, which it entirely encompasses. The ventral pad for the attachment of tendons is broad, rounded and flattened, about 78 mm. in length from the proximal border of the phalanx. Dorsally the bony sheath extended at least 63 mm. from the base of the claw, and thence forward and downward to the apex

of the ventral disc for tendinous insertion. Apparently the bone is more compressed and deeper than in *M. robustus*.

It was upon a third ungual phalanx and some other phalanges from Oregon that Cope (1878) based his *Mylodon sodalis*. He says that the bony sheath at the base of this large claw is developed on but one side only, and that its place on the opposite side is taken by a prominent rim, tuberculate and notched. His figure, subsequently published (Cope, 1889), seems to indicate a sheath covering the basal third of the claw. The measurements are not very different from those of the specimen studied, but indicate perhaps a slightly more slender claw-bearing portion. Comparative measurements are given under the heading of *Mylodon sodalis*.

The terminal phalanx of the fourth digit (Plate 3, fig. 11) is bluntly pointed with a deep notch about half way on its ventral outline. It is 44 mm. long and articulates with the cotylus of the next proximal phalanx by a facet of an inverted-heart shape, whose lateral portions are very slightly concave.

The fifth digit ends in a small rounded button of 23 mm. in greatest breadth. The next proximal phalanx is an irregularly rectangular bone in dorsal aspect, 42 mm. long, and not so compressed as that of *M. robustus*.

Of the *pelvis* a portion only can be reconstructed from the fragments. This constitutes about a third of the right-hand shield external to the acetabulum, the distance from which to the outer corner is about 250 mm. Along the superior margin there is a rim turning forward at nearly right angles, and of gradually increasing width, as in *M. robustus*. Its edge is roughened and slightly tuberculate for muscle attachment. The structure of the pelvic plate is rather characteristic; the superficial portions are of densely formed bone, while between is a central layer of a porous or cancellar nature. The three layers are rather sharply marked off.

The *femur* is of the same type as that of *M. robustus*, but differs in a few minor details. That of the right side is the better preserved and has an approximate length of some 500 mm., a trifle greater than in Owen's specimen. It shows the concave outline of the inner side, when viewed from in front. The great trochanter extends as a roughened ridge about half the outer length of the shaft. The condyle is large and somewhat hemispherical and differs from that of *M. robustus* as figured by Owen in that the depression for the ligamentum teres is of triangular outline, with the point toward the center of the condyle whereas in Owen's specimen it is broad and expands into a rounded depression. The part of the femur between the condyle and the great trochanter seems

considerably more compressed instead of being nearly the width of the articular head. The distal condyles are of about the size of those in the South American species, but in end view the concavity at the knee for the reception of the patella and its ligaments, is much flatter and apparently a little broader. The femur presents the following measurements:—.

Antero-posterior diameter of proximal condyle, *circa*	125 mm.
Lateral diameter of same	118
Depression for ligamentum teres, base, 38; height,	58
Breadth of femur across middle of shaft	165
Width of articular surface for patella (anterior face of knee)	107
Greatest width across distal condyles (posterior view)	198
Greatest width of outer posterior condyle	68
Greatest vertical height of same	58
Greatest width of inner posterior condyle	82
Greatest vertical height of same	97
Ventral width of isthmus between distal condyles	58

The *patellae* are almost squarely truncate across the top, but at the outer upper corner are bordered by a thick ridge of bone that projects above the general dorsal outline. Ventrally the sides of the bone converge to a blunt point. In *M. robustus* there is a raised portion of bone visible along the entire dorsal edge of the articular facet, as seen in posterior view. This facet is of different shape in the two patellae of the specimen studied. In one it is slightly narrower and longer than in the other, 39 to 44, and 113 to 102 in comparative diameters.

The remarkably short and broad *tibia* is nearly identical with that of the South American Mylodon. That of the left side measures in extreme length between uprights 255 mm.; in extreme breadth across the proximal facets, 171 mm. The broad thick shaft contracts to a width of 100 mm. at the middle and expands distally to 131 mm. across the malleoli. Of the two articular facets at the proximal end, the external has a practically flat surface, separated by a depression from the slightly hollowed and larger internal facet. The long axes of both are nearly parallel and at about 45 degrees to an antero-posterior line. In *M. robustus* the smaller facet is of slightly more oval outline with its axis nearly at right angles to that of the larger. These peculiarities are no doubt subject to much individual variation. The outer facet is the upper surface of a projecting shelf whose lower portion forms an articulation for the proximal end of the fibula, of roughly elliptical outline, transversely placed. The internal malleolus at the distal end of the tibia is slightly less expanded than in

M. robustus. The distal facets are similar in both species. The right-hand tibia is nearly 20 mm. shorter than the other, and a similar discrepancy occurs in the fibulae. Leidy (1889, p. 35) gives 10 inches or 233 mm. as the extreme length of the tibia of *M. harlani*. In both it is apparently longer than in *M. robustus*.

The *fibula* is of the same general form as in the South American Mylodon with an obliquely truncate articular surface internally, and a thickened external ridge bearing a small facet for articulation with a sesamoid. The roughened portion at the lower half of the shaft is, however, much less apparent, and the shaft itself is rather smooth throughout. The arrangement of the distal facets is quite different. Of *M. robustus* Owen (1842, p. 116) writes: — "The inner surface of the distal expansion presents a concavity, two flat synovial articular surfaces, and an intermediate rough ligamentous tract. The upperpart of the concavity is very irregular; its lower part is formed by a flat oblique articular surface. * * * A narrow, slightly concave, transverse tract divides the upper from the lower articular surface; this is of less extent than the one above; its plane is vertical, looking directly inwards, and is adapted to the flat surface on the outer side of the astragalus." In the specimen studied the two facets (Plate 4, fig. 21) are present as described, the upper one with its plane slightly oblique, but instead of a "transverse tract" separating the two, their boundaries are contiguous at the angle where the two planes intersect. In this respect the Nebraska specimen is similar to Paramylodon as described by Brown so that the character cannot be ascribed generic value. The astragalar facet occupies about one half the width of the distal end of the bone, and is vertically elongate. The Mylodon fibula described and figured by Williston (1895, p. 175) is larger than either of those studied, and has the two distal facets separated as in *M. robustus*. It was obtained at Seneca, Kansas, from a well, 50 feet below the surface in alluvium. Williston refers it provisionally to *M. harlani*, at the same time calling attention to its apparently larger dimensions, as deduced from Leidy's measurements of tibiae. Its greatest length was 290 mm. Of the two fibulae of the specimen here described that of the left-hand side is the longer, 265 mm.; that of the right-hand side is less, 234 mm. These latter measurements accord more nearly with what may be assumed, from the tibiae, to be the length of fibula in *M. harlani*. As suggested by Williston, his specimen may represent a different species, but until undoubted fibulae of *M. harlani* are found, this point cannot be settled.

The bones of the *hind foot* seem to be essentially similar to those of *M. robustus*, as described and figured by Owen. The peculiarly shaped astragalus is smaller than that of Paramylodon, 140 mm. in greatest width, and 111 mm.

in height, as against 150 and 127 respectively for *P. nebrascensis* as given by Brown. Both calcanea are imperfect but present no especial peculiarities. The hind foot was provided with four toes, of which the two inner bore large claws, as in other species of the genus. Owen considers that it is digit I which is wanting. Digit 2 has the smaller and digit 3 the larger claw. That of the former (Plate 3, fig. 13) is straight, conical, and somewhat flattened ventrally. An angular ridge forms the lateral boundary between the upper and the lower surface. A large thickened disk of bone is present at the base of the claw ventrally, below the level of the proximal cotylus. The extreme length of the phalanx is 77 mm.; its greatest depth at the anterior end of the ventral disk 34 mm. The basal sheath of thin bone is largely broken away. The claw of digit 3 (Plate 3, fig. 12) is very large, next in size to the great claw of the manus. Its shape, however, is different, for instead of being practically straight in dorsal view its long axis is bent in a slight arc inward. The distal third is marked with a shallow dorsal groove, and the tip is much flattened dorsoventrally. Compared with the corresponding bone in the mounted specimen of *M. robustus* in the Museum, it is much more slender and laterally compressed. Its greatest length is 167 mm.; its depth at the base 48 mm.

The two phalanges of digit 4 are present, of which the terminal (Plate 3, fig. 14) is a short, bluntly pyramidal bone 42 mm. long, with a deep notch ventrally near the base for tendinous insertion. It articulates with the somewhat square and anteroposteriorly compressed basal phalanx whose ventral border is emarginate for the passage of a tendon, and whose posterior face is deeply hollowed for articulation with metatarsal 4. The terminal phalanx of digit 5 (Plate 3, fig. 15) is similar but smaller.

Dermal Ossicles.— Accompanying the large bones of the body are a number of small dermal ossicles, which are mainly round or ovoid in shape, or occasionally lozenge-shaped. The round ones vary from 3 to 8 or 9 mm. in diameter; one elongate ossicle is 12 mm. in length by 5 mm. in transverse diameter. Another is flattened and squarish, about 8 mm. on a side. These are very different in shape from the dermal ossicles described by Sinclair (1910) for Paramylodon. The latter were found overlying the scapula, and are apparently larger, more often squarish or rhomboid in outline, or irregularly shaped.

Comparison with Mylodon sodalis Cope.

In 1878, Cope named and described *Mylodon sodalis* as a new species, basing his account particularly on an ungual phalanx "from the Pliocene of Oregon," and briefly mentioning other proximal phalanges. Later (1889)

he published a figure of the type phalanx, and in 1893, writes that he had since received from George Duncan, of Paisley, Oregon, an imperfect symphysis mandibuli from near the original locality. He doubtfully refers to *M. sodalis* "the distal part of a femur, lacking part of the internal condyle and adjacent epicondyle" from the Llano Estacado of Texas. It was found associated with species of the Equus fauna similar to those of the Oregon beds at Silver Lake. Matthew (1902) in his list of the Pleistocene fauna from Hay Springs, Nebraska, gives a revision of Cope's list of species from Silver Lake, and includes *Mylodon sodalis* as possibly synonymous with *M. harlani*. He also lists astragali and foot bones of "Mylodon sp." from Washtuckna Lake, Washington, a new locality for the genus. With regard to the ungual phalanx on which Cope founded *M. sodalis*, Osborn (1910, p. 459) suggests that it may prove to be that of a Megalonyx, but Cope's figure published in 1889, seems more nearly to resemble the claw of Mylodon, and is less curved than the large claw of Megalonyx. The original description states that the ungual phalanx "has its basal sheath developed on one side only; its place is taken on the opposite side by a prominent rim, which is tuberculate and notched. The rim is low on the superior part of the proximal extremity, and is separated from the articular cotylus by a concave subvertical surface, wider than long. The basal tendinous insertion is subdiscoid and flat, with a lateral projecting rim, which is pierced at the base by the arterial foramina. The general form of the phalange is more compressed than in *Mylodon harlani*. Its superior middle line is broadly rounded, and continues nearly uniform to the apex. One side is subregularly convex; the other is divided into three planes. The middle one of these is flat, and terminates in a short lateral ridge which extends to the apex. The superior plane becomes somewhat concave near the apex, and the inferior gently convex" (Cope, 1878, p. 385). This description applies well enough to the large ungual phalanx of the fore foot in *Mylodon garmani* but does not indicate that the two are identical. Nor has it been possible to compare Cope's specimen with Paramylodon. Cope gives the following measurements (and in parentheses I have added those of our specimen):—

Length of ungual phalanx	185 mm.	(177)
Vertical proximal depth	58	(59)
Vertical depth at middle of inferior tendinous tuberosity	55	(61)
Vertical depth just beyond inferior tuberosity	44	(37)
Width of proximal cotylus	52	(37)
Width of unguis at middle	33	(30)
Width of unguis near end	20	(15 ±)

Until more material from the same locality and formation is available, it does not seem best to attempt the definite identification of Cope's *Mylodon sodalis*. The supposed lack of the bony sheath on one side of Cope's type specimen seems more than likely to be due to a breakage, for in one of the phalanges of our specimen a similar appearance is presented where the thin sheath has broken so smoothly away on one side as to suggest that this is its normal condition, but the broken piece was found and fitted perfectly.

Comparative Notes on Mylodon harlani Owen.

This species, though known from numerous fragments from many parts of the southern United States, has never been adequately described. It was based on a portion of the ramus including the lower dentition from Big Bone Lick, Kentucky. Cope (1895) subsequently described and figured teeth from Louisiana, which were assumed to represent the upper series. In the same paper he names two new species, *M. renidens* and *M. sulcidens*, which appear to represent the same animal, and are currently regarded as synonyms of *M. harlani*. Leidy (1885, 1889) lists a number of bones in the collections of the Academy of natural sciences and the Wagner free institute at Philadelphia, including a left malar bone, fragments of vertebrae, and of limb bones and pubis. The complete skull remains unknown. Prof. T. D. A. Cockerell, however, in 1909 published a short account, with photographic figures of a Mylodon cranium discovered on a farm near Walsenburg, Colorado. This he inclined at first to consider the same as *Paramylodon nebraseensis* but decided it might be in reality an undescribed species. Through his kindness I have been able to examine carefully the original photographs as well as drawings of the tooth sockets, made at my request by Professor Cockerell. The upper teeth were five as typically in the genus, and although there are certain resemblances to the skull of Paramylodon, the differences are marked. After a careful comparison with Cope's figures, drawn natural size, of the upper dentition, and allowing for the fact that the diameters of the tooth sockets are several millimeters in excess of those of their respective teeth, I am impressed by the very close correspondence both in form and in measurements between Cope's figures and Professor Cockerell's photographs and drawings, so that there seems little doubt that the Colorado skull should be referred to *M. harlani*, of which no entire cranium had hitherto been discovered.

In 1843, Harlan described as a new species under the name *Orycterotherium missouriense* the remains of three Mylodons found on the Big Bone River, a

tributary of the Osage River, Missouri. These were subsequently examined by Owen who considered them identical with *M. harlani*. Among the specimens are sixteen loose teeth, together with eight others in sockets, two humeri, portions of pelvis, sternum, and foot bones. At about the same time, Dr. H. C. Perkins described with some care a tooth and a humerus found twelve feet below the surface on the Willamette River, Oregon. For these remains, if belonging to an undescribed animal, he proposes the name *Oryctcrotherium oregonensis* (Amer. journ. sci., 1843, ser. 1, **44**, p. 80, footnote). This humerus is now in the collection of the Boston society of natural history, but the tooth is lost sight of. Leidy (1855, p. 48) further confirms the identity of this bone with *M. harlani*. He describes a humerus from Big Bone Lick, Kentucky (the type locality) and states that its measurements accord with those of the Oregon specimen. This latter is much larger than that of the Nebraska Mylodon here described. It measures:—

Greatest length,	510 mm.
Greatest breadth across distal end,	285
Width across distal condylar surfaces,	155
Antero-posterior extent of same,	87

Harlan in his account of the remains from Missouri gives the total length of a humerus as 20 inches (about 508 mm.), the breadth across the distal condyles, 6 inches (about 152 mm.), which is quite in accord with the dimensions of the Oregon humerus.

In the collection of the Museum of comparative zoölogy there is a fragment of the tip of a Mylodon mandible (Plate 4, fig. 16) labeled "Walhaumet River, Oregon," which, though it has no further history was evidently received many years ago, before the spelling "Willamette" for this river was adopted. The bone is stained a dark brown like the humerus from the same locality, and it is probable that it is from the same place or even from the same specimen. Assuming that it represents *M. harlani*, it supplies a portion hitherto undescribed, namely the predental part of the jaw. It includes the tip of the left ramus broken slightly to the right of the middle line of the symphysis, with at its posterior edge the basal part of the socket for the first tooth. It is clearly not referable to *Paramylodon nebrascensis*, in which the symphysis is considerably longer and narrower with a decided keel. From the Mylodon whose skeleton I have just described, it differs equally in the breadth of the truncate tip of the jaw, in the nature of the symphysis, and in the arrangement of the openings of the dental canal. These last in the Oregon fragment consist of two large sub-

equal openings, the anterior 25 mm. in advance of the posterior and some 15 mm. in long diameter, with a very small third opening (4 mm. in diameter) below and between these two. In the other specimen on the contrary, the three openings are in a row, the anteriormost large, the two others small. Further, the symphysis of the Oregon specimen is about 109 mm. long or some 15 mm. shorter than in the Nebraska species, and there is at its base a flattened triangular area whose apex extends for nearly 70 mm. toward the tip of the ramus. The terminal part of the ramus was much broader transversely than in either Paramylodon or *Mylodon garmani*; it was more abruptly truncate, and about 120 mm. across as against about 85 in the latter species. It therefore more nearly resembles *M. robustus* in having a broad truncate lower lip, and was thus adapted more for a grazing habit, while Paramylodon and *M. garmani* with their elongate and compressed rami, were probably browsing animals. The reduction of the humerus in the latter may also be correlated with this habit, implying that it raised itself up to reach for branches rather than to grub for roots. The distance from the socket of the first tooth to the tip of the ramus in the median line is about 150 mm. in both species of Mylodon, but in Paramylodon was apparently much greater, since the ramus is more produced in that genus.

Concerning Paramylodon, as to the validity of which some doubt has been expressed, it seems that its claims to generic rank are well founded. Its reduced dentition and elongate rostrum, with other characters pointed out by Brown seem sufficiently trenchant. The contiguity of the astragalar and tibial facets of the fibula, however, cannot be considered of generic value, since this condition is also found in *M. garmani*.

SUMMARY.

Of the genus Mylodon, there were at least two types in the North American Pleistocene, one represented by *M. harlani*, a grazing type; the other represented by *M. garmani*, here described, apparently a browsing type. The one had a broad lip, heavy humerus, tibial and astragalar facets of the fibula separate; the other had a narrower more compressed skull and rostrum, a lighter humerus, tibial and astragalar facets not separated (agreeing thus with Paramylodon). Also, as a further adaptation to the browsing habit, certain of the dorsal vertebrae have three articulating facets for greater mobility in reaching upward, a condition found in Megatherium but not in *Mylodon robustus*, a grazing species of South America.

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PLATE 1.

PLATE 1.

MYLODON GARMANI.

Fig. 1.— Side view of skull.
Fig. 2.— Side view of jaws (tip of left ramus slightly broken).

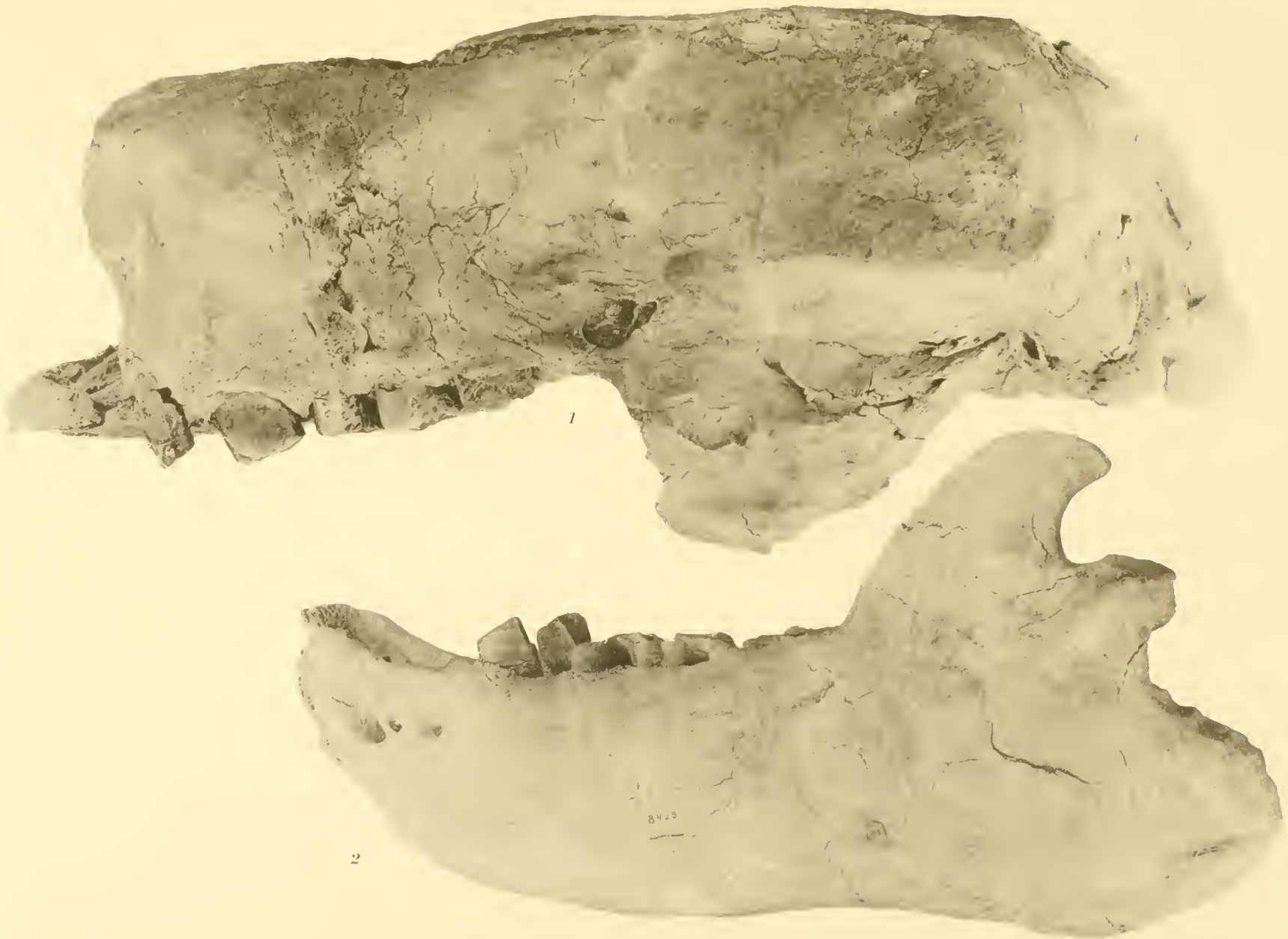
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PLATE 2.

PLATE 2.

MYLODON GARMANI.

Fig. 3.— Ventral view of skull.
Fig. 4.— Lower jaws from above.

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PLATE 3.

PLATE 3.

Mylodon garmani.

Fig. 5.— Complete hyoid apparatus in lateral view.
Fig. 6.— Anterior view of the body of the hyoid.
Fig. 7.— Jugal in side view.
Fig. 8.— Third ungual phalanx of fore foot.
Fig. 9.— Second ungual phalanx of fore foot.
Fig. 10.— First ungual phalanx of fore foot.
Fig. 11.— Terminal phalanx of fourth digit of fore foot.
Fig. 12.— Ungual phalanx of digit 3 of hind foot.
Fig. 13.— Ungual phalanx of digit 2 of hind foot.
Fig. 14.— Terminal phalanx of digit 4 of hind foot.
Fig. 15.— Terminal phalanx of digit 5 of hind foot.

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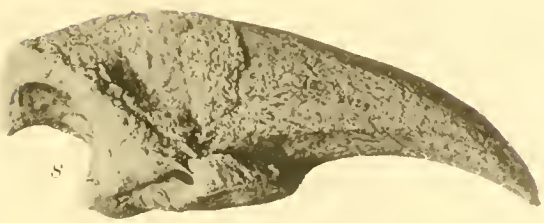

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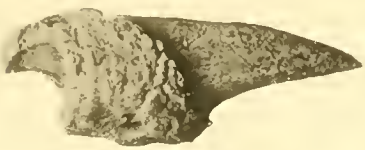

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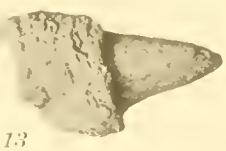

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PLATE 4.

PLATE 4.

Mylodon garmani.

Fig. 16.— Tip of left ramus of a Mylodon from Oregon, considered as representing *M. harlani*.

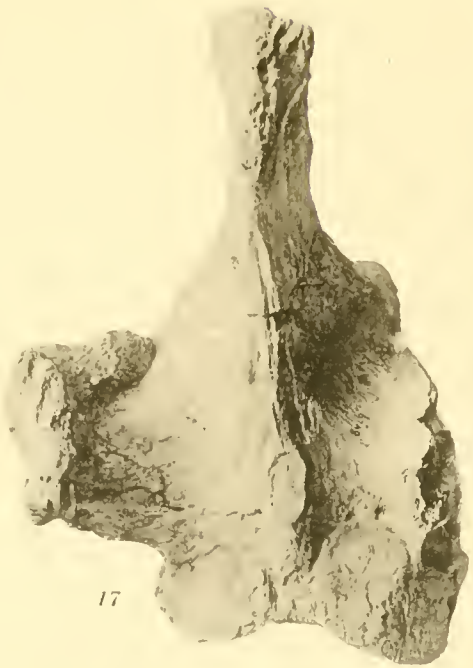
Fig. 17.— Portion of a dorsal vertebra showing three articulating facets anteriorly. On its posterior side there are but the usual two facets, since it is the last of the three-faceted vertebrae.

Fig. 18.— Spine of one of the vertebrae anterior to the last, showing three facets on its posterior aspect.

Fig. 19.— Dorsal view of the atlas.

Fig. 20.— Lateral view of the axis.

Fig. 21.— Ental aspect of the fibula, showing (at the right-hand end) the facet for articulation with the upper end of the tibia, and (at the left-hand end) the astragalar and the tibial facets at nearly right angles but in contact. The surface of the former is slightly crushed.



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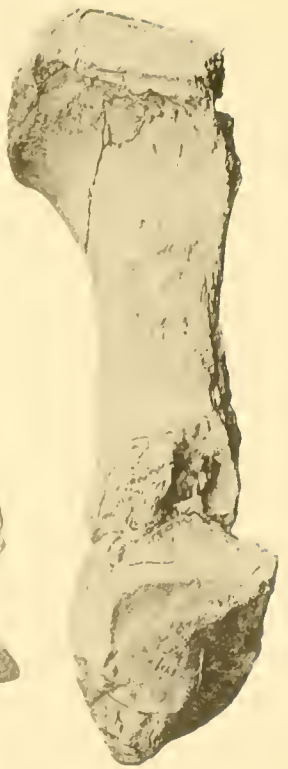

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